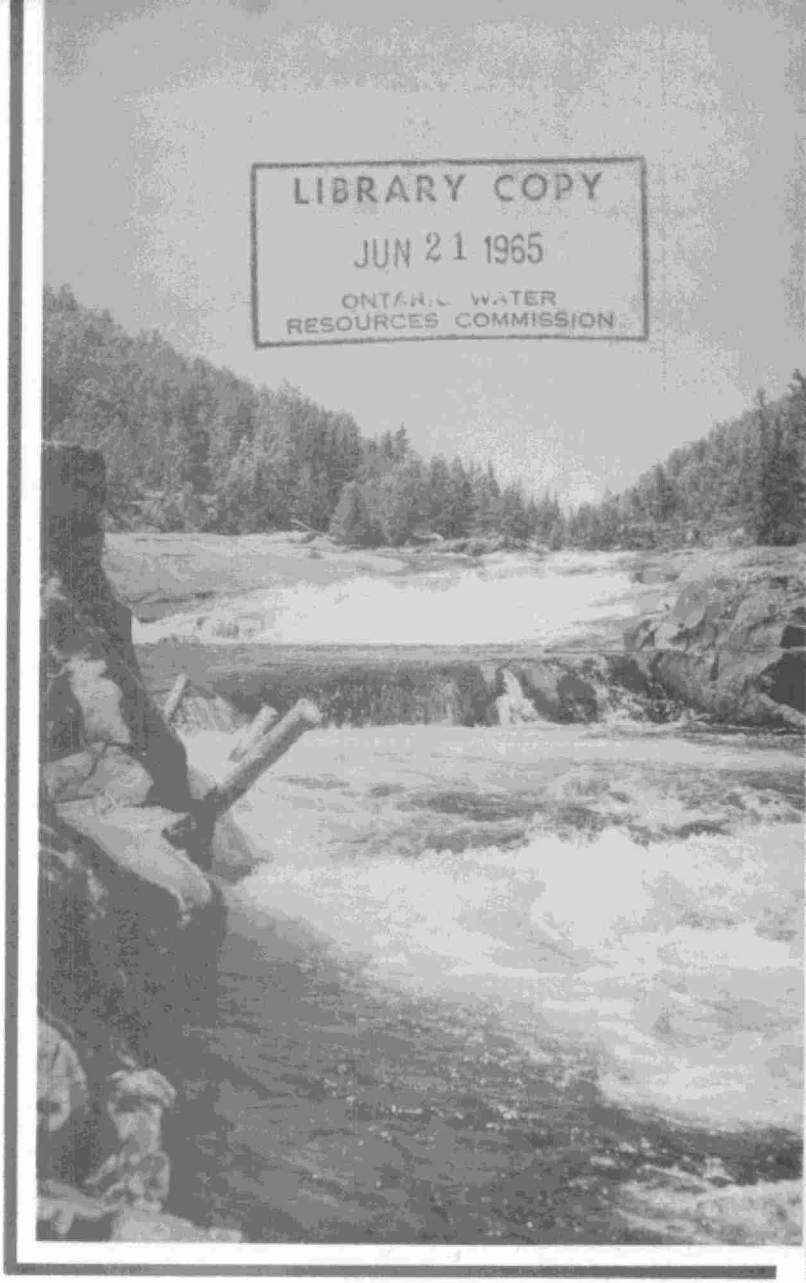
Stratford Water Pollution Control Plant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ONTARIO WATER
RESOURCES COMMISSION

1963 Annual Report

Ontario Water Resources Commission

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ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Mayor and Members of Council,
City of Stratford.

Gentlemen:

I am pleased to submit, for your information, the 1963 Annual Operating Report of the Stratford Water Pollution Control Plant, OWRC Project No. 57-S-2, which has been prepared by our Division of Plant Operations.

We are grateful for the kind cooperation which you and your staff have extended to our Operations staff throughout the year. We look forward to a continuing close association with you in our mutual endeavour to control pollution.

Yours very truly,

D. S. Caverly,
General Manager

General Manager,
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Stratford Water Pollution Control Plant, OWRC Project No. 57-S-2 for 1963.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B. C. Palmer,
Director,
Division of Plant Operations.

foreword

This report is designed to present the highlights of the operation of these works during 1963. Trends in flows and other operating data can be extremely useful in the development of necessary long range enlargement and improvement programs.

In addition to the activities reported herein, much unrecorded effort has contributed to the success of this operation. The municipality, through representatives on the Local Advisory Committee, have given valuable assistance in reviewing salary schedules, detailed operating budgets, personnel problems, flow patterns, and major maintenance problems.

The Division of Plant Operations has provided direction to the field staff in administrative procedures, quality control, maintenance schedules, equipment inspection and purchase supervision. A number of other Divisions of the Commission have been of service. The Division of Construction has offered helpful advice on equipment selection and renovation problems. The Division of Sanitary Engineering has maintained, through its District Engineering staff, a keen interest in the operation and has made a number of constructive recommendations. Its operator training courses have been very helpful. The Division of Finance has processed many payrolls, purchase orders and invoices dealing directly with this project. The Commission Personnel Director has been most helpful in counselling of personnel problems.

The excellent cooperation of all of these groups is gratefully acknowledged.

B. C. Palmer,
Director,
Division of Plant Operations

C. W. Perry,
Assistant Director
D. A. McTavish,
Regional Supervisor
B. G. Porter,
Operations Engineer

ONTARIO WATER RESOURCES COMMISSION

DIVISION OF PLANT OPERATIONS

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Total Costs.....Inside back cover

STRATFORD WATER POLLUTION CONTROL PLANT

OPERATED FOR

THE CITY OF STRATFORD

BY

THE ONTARIO WATER RESOURCES COMMISSION

CHAIRMAN

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J. H. H. Root, M. P. P.
J. A. Vance, LL. D., P. Eng.
A. A. Wishart, Q. C., M. P. P.

GENERAL MANAGER

D. S. Caverly

ASSISTANT GENERAL MANAGERS

G. M. Galimbert
L. E. Owers

COMMISSION SECRETARY

W. S. MacDonnell

1957 to 1963 History

INCEPTION

In 1957, the City of Stratford and the Ontario Water Resources Commission initiated plans to extend the existing activated sludge treatment plant, which had been in operation since 1930.

The firm of Canadian-British Engineering Consultants was engaged to prepare plans and specifications for the project.

On July 5, 1957, the city signed an agreement with the Ontario Water Resources Commission to finance, construct and operate the plant.

CONSTRUCTION

Schwenger Construction Company Limited of Hamilton began construction in 1957 and, in June of 1958, the Division of Plant Operations commenced operation of the new plant.

TOTAL COST

The cost of this plant extension was $927,382.00.

Project Staff

Clifford W. Biggin,
Chief Operator

Operators:

J. Craig
W. McManus
J. E. Gotts
R. P. Ranton
R. Tuer

COMMENTS

The plant is operated quite satisfactorily with the above complement of staff. A casual labourer was employed for the entire twelve months of 1963 due to the resignation of one operator in January 1963. This vacancy has now been filled and the casual labourer was subsequently disengaged. The plant is staffed 24 hours per day, seven days per week. Schedules are arranged to allow each man two days off per week.

Mr. Gotts attended the basic course in plant operating sponsored by the OWRC during 1963. During 1964, Mr. Gotts will attend the intermediate and senior courses and another operator will attend the basic course.

RECOMMENDATIONS

Casual labour will be required during the summer; and to replace the operators who are on vacation during 1964. A permanent groundskeeper-operator is recommended for future consideration in place of casual labour.

Description of Project

INFLUENT WORKS

An inlet channel, fitted with a storm overflow weir for flows in excess of 16 MGD, conducts the sewage from two large concrete sewers to the screening chamber. The screening chamber is divided into two parallel channels, one of which contains a "barminutor" which cuts and shreds the solid materials in the sewage. The second channel is fitted with a manually cleaned bar screen used only when it is necessary to by-pass the barminutor.

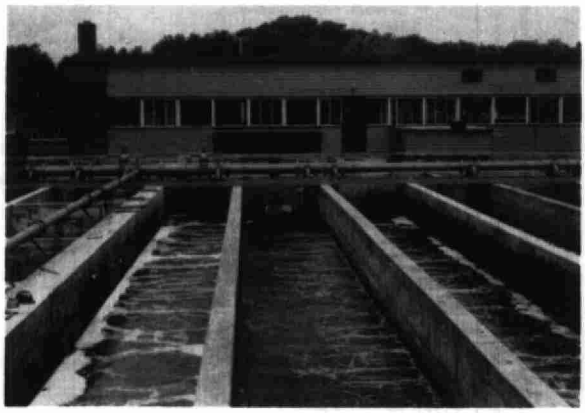
Flow continues by gravity to a shallow settling tank where grit settles out and is removed by a Dorr detritor mechanism. A grit washing mechanism and organic return pump completes the influent works. The cleared grit is discharged to a barrow and subsequently disposed of by burial on the plant grounds.

PRIMARY CLARIFIERS

Four circular concrete clarifiers, each 80' in diameter, receive flow from the influent works. Primary sedimentation of flows up to 8 MGD is accomplished using two tanks and the other two are kept empty to handle storm flows up to 16 MGD. In either instance, the minimum detention is two hours.

Circular sludge collector and scum collector mechanisms move the settled and the floating primary sludge to sludge hoppers. This primary sludge is then pumped to the digestion tank via sludge pumps located in the machinery building.

The primary clarifier effluent flows over a peripheral weir and is directed to a main sewage pump well under the machinery house.

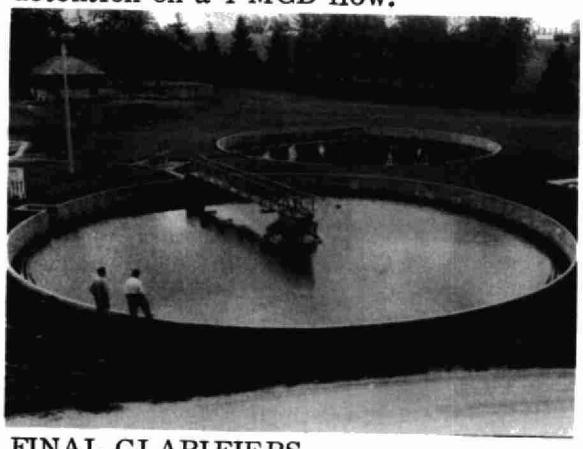


AERATION

Main sewage pumps lift a maximum of 8 MGD from the pump well to three triple pass aeration tanks where it is mixed with activated sludge returned from the final settling tanks. In the aeration tanks air is introduced into the mixed liquor through 7" diameter steel dome diffusers.

The air is supplied by three compressors, each with a capacity of 1750 cubic feet per minute.

The aeration section provides five hours detention on a 4 MGD flow.



FINAL CLARIFIERS

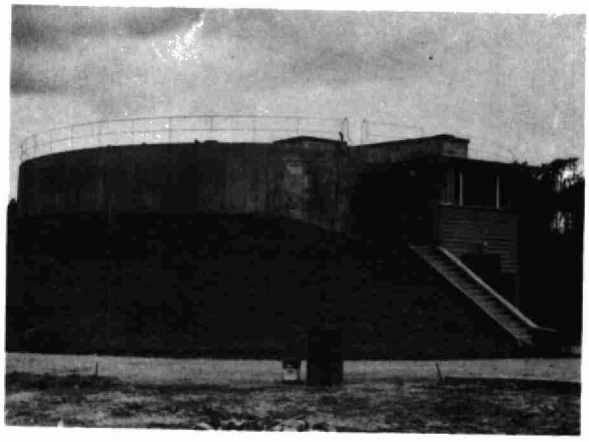
Two 80 foot diameter concrete final clarifiers detain the flow from the aeration tanks, allowing the activated sludge to settle out. Some of this activated sludge is returned to the head of the aeration tanks to supply the bacteria needed for aerobic digestion of the solids loading from the primary tanks. The remaining activated sludge is "wasted" to the primary clarifiers where it settles and joins the raw sludge going to the digestion tank.

The clear liquid overflows a peripheral weir and is conducted to the river as final effluent.

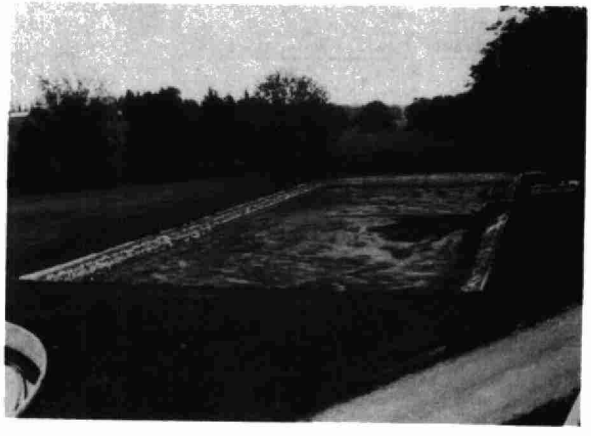
SLUDGE DIGESTION TANK

Sludge from the primary clarifier composed of raw sludge, scum and waste activated sludge is pumped to a circular two stage digester. The digester is 73 feet in diameter, 26 feet deep, and has a capacity of 100,000 cubic feet.

A cylindrical partition wall divides the digester into two compartments. Active



digestion, incorporating recirculated gas mixing and heating coils to maintain a temperature of about 95° F. takes place in the inner tank which has a capacity of 67,600 cubic feet. The annular outside compartment forms a quiescent zone where gradual settling occurs. Supernatant liquid which has a very low percentage of solids is gravitated to the primary clarifiers.



Thickened digested sludge is piped from the digester to a sludge storage tank and is transported under contract to farm land where it is used as a soil conditioner.

The digestion process requires about one month. Methane gas, formed during digestion, is stored under the digester roof and used as fuel for heating the plant.

Design–Data

GENERAL

Type of Plant - Activated sludge.

Design Population - 30,000 persons.

Design Plant Flow - 4 MGD

Per Capita Flow - 130 GPD

Five Day BOD -

Raw Sewage	-	140 PPM
Removal	-	95%

Suspended Solids -

Raw Sewage	-	250 PPM
Removal	-	95%

PRIMARY TREATMENT

Screening

Barminutor - Chicago Model "C" 18" width.

Detritor - Dorr mechanism.

PRIMARY CLARIFIERS

Type - Four concrete circular structures.

Size - 80' diameter x 10'6" SWD.

Volume - 1,320,000 gallons.

Retention - 4 hours @ DWF.

Overflow Rate - 8,000 gallons per lineal foot per day.

Mechanism - Infilco Model BF.

SECONDARY TREATMENT

Aeration Section

Type - 7" diameter steel dome diffusers supplied by Activated Sludge Ltd.

Tank Volume - 970,000 gallons.

Retention - 5.7 hours.

Return Sludge - 20%

Air Supply - 1.22 cubic feet per gallon.

Compressors - Rotary type.

FINAL SETTLING TANKS (2)

Type - Two concrete circular structures.

Size - 80' diameter x 11'3" width.

Volume - 705,000 gallons.

Retention - 4 hours.

Overflow Rate - 8,000 gallons per lineal foot per day.

Mechanism - Infilco Model BD.

DIGESTION SYSTEM

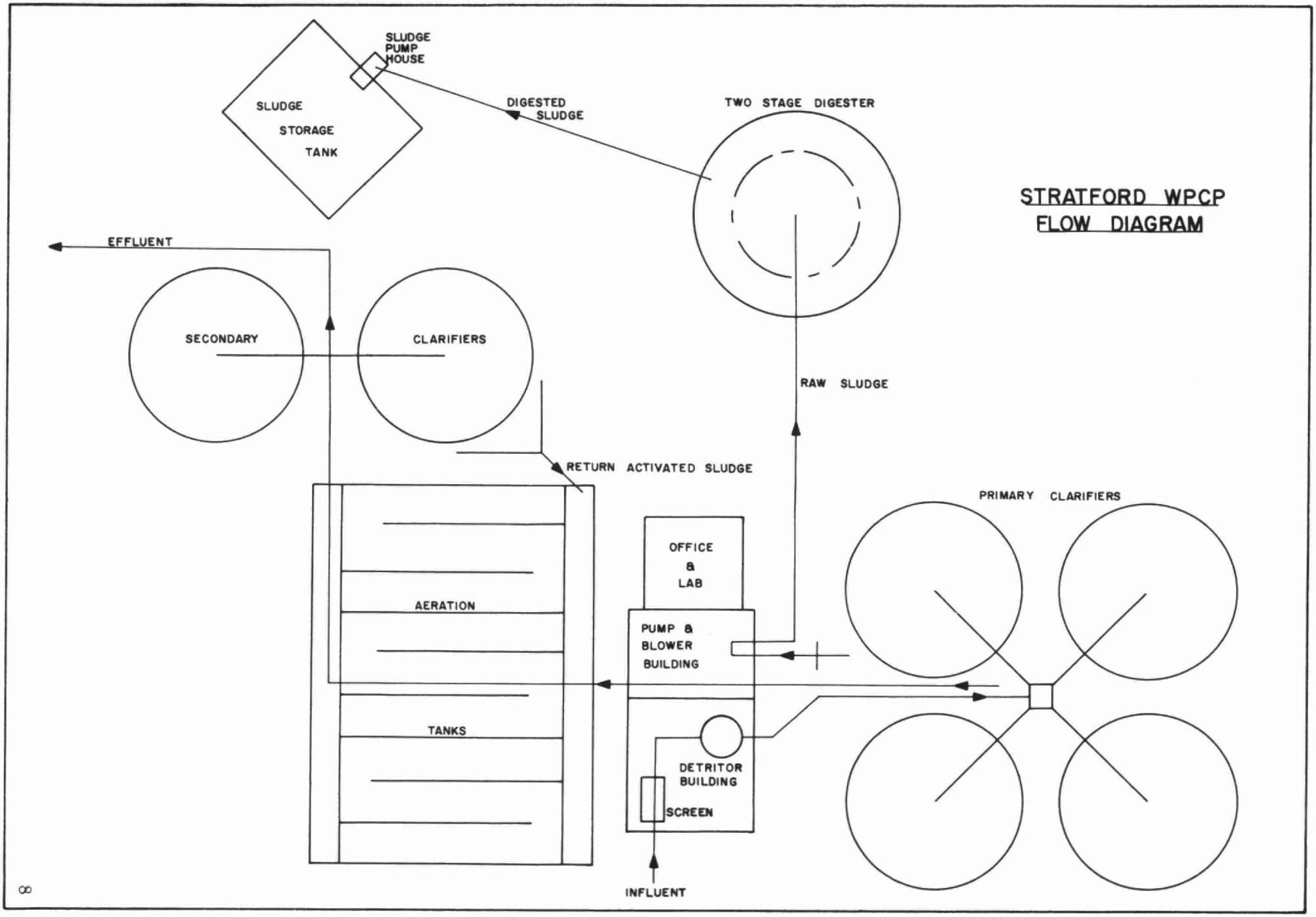
Type - Heated two stage digester.

Size - 73' diameter x 26' width.

Volume - 100,000 cubic feet.

Capacity - 2.25 cubic feet per capita.

Loading - 1.85 pounds solids per cubic foot per month.


SLUDGE PUMP HOUSE
SLUDGE STORAGE TANK
DIGESTED SLUDGE
TWO STAGE DIGESTER
STRATFORD WPCP FLOW DIAGRAM
EFFLUENT
SECONDARY CLARIFIERS
RAW SLUDGE
RETURN ACTIVATED SLUDGE
PRIMARY CLARIFIERS
OFFICE & LAB
AERATION
PUMP & BLOWER BUILDING
TANKS
DETRITOR BUILDING
SCREEN
INFLUENT

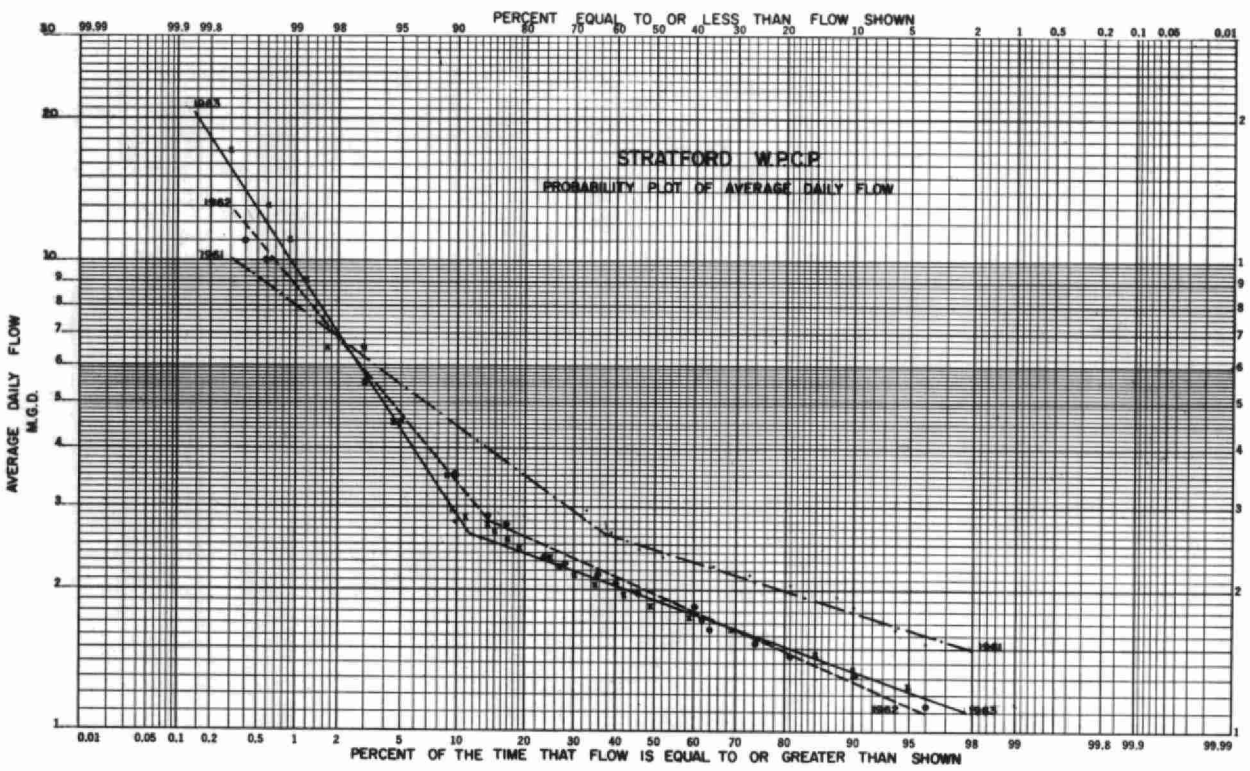
Process Data

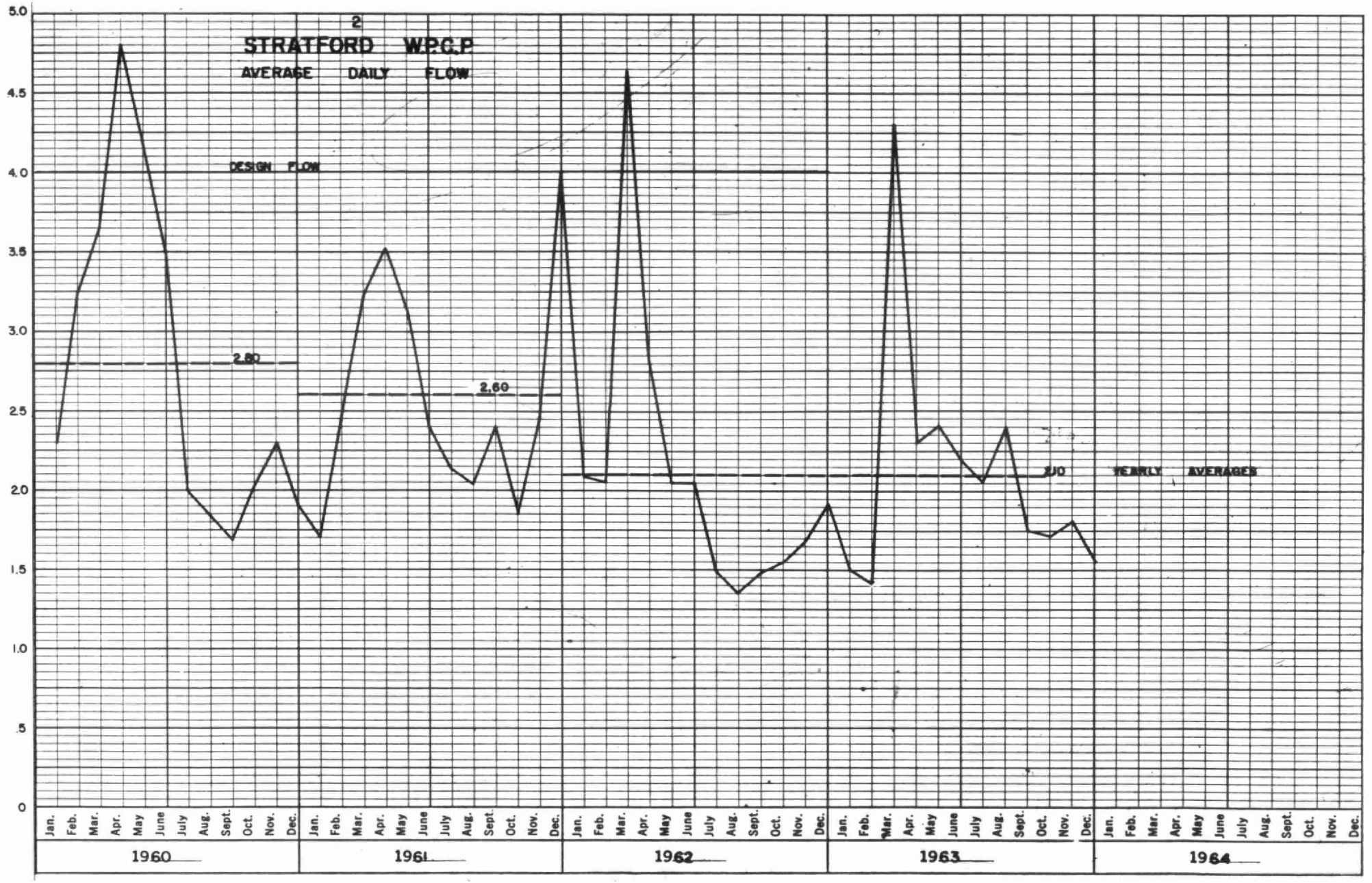
FLOW

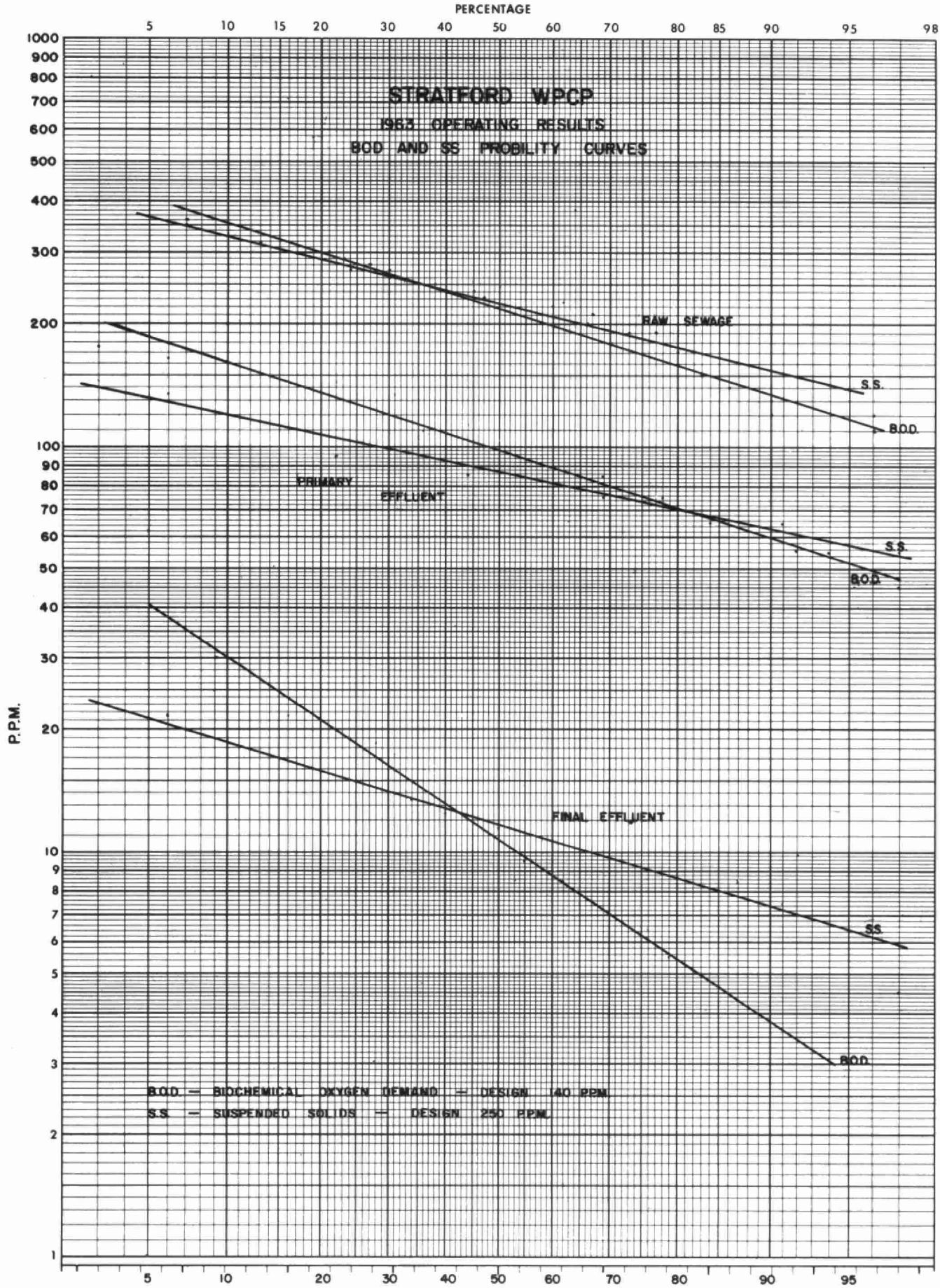
The average daily flow and total flow for the year were slightly increased over the 1962 flows. During 1963, the average daily flow was 2.12 million gallons, an increase of 1.4% over the average 2.09 million gallons per day received during 1962. During the past year, 774 million gallons of raw sewage composed of both industrial and domestic wastes received complete treatment.

The maximum 24 hour flow in the past year was 16.8 million gallons and occurred in the month of March. The versatility in design of this plant enables flow rates up to 8 million gallons per day to receive complete treatment for short periods. In addition, two of the primary tanks are used as storm units and can be used to store flash flood waters for treatment when the flow subsides. Primary treatment can be given to flow rates up to 16 million gallons per day. For these reasons, it is only on very rare occasions that part of the flow must be by-passed.

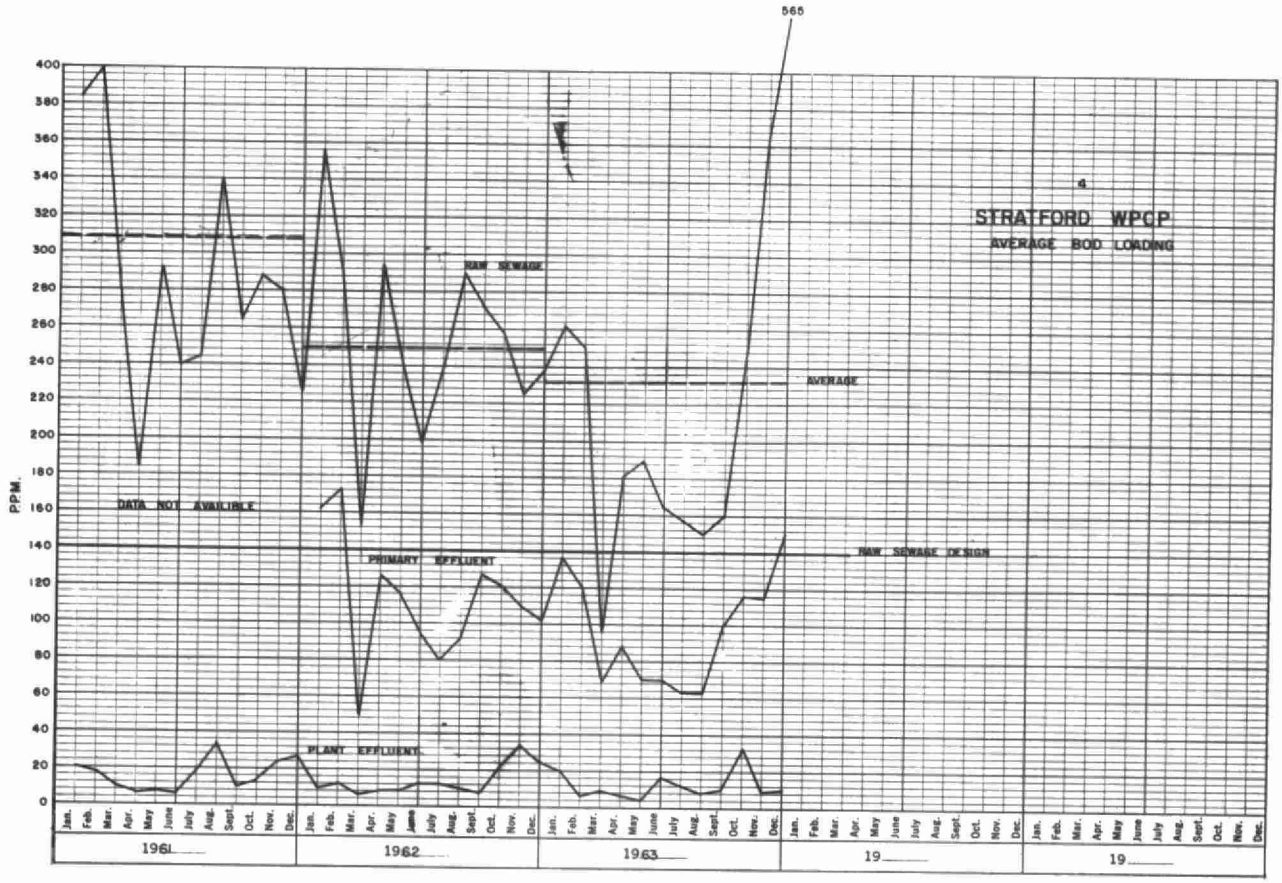
The probability curves are compound; the steeper sloped portion representing storm flows and the lesser sloped portion representing normal dry weather flows.

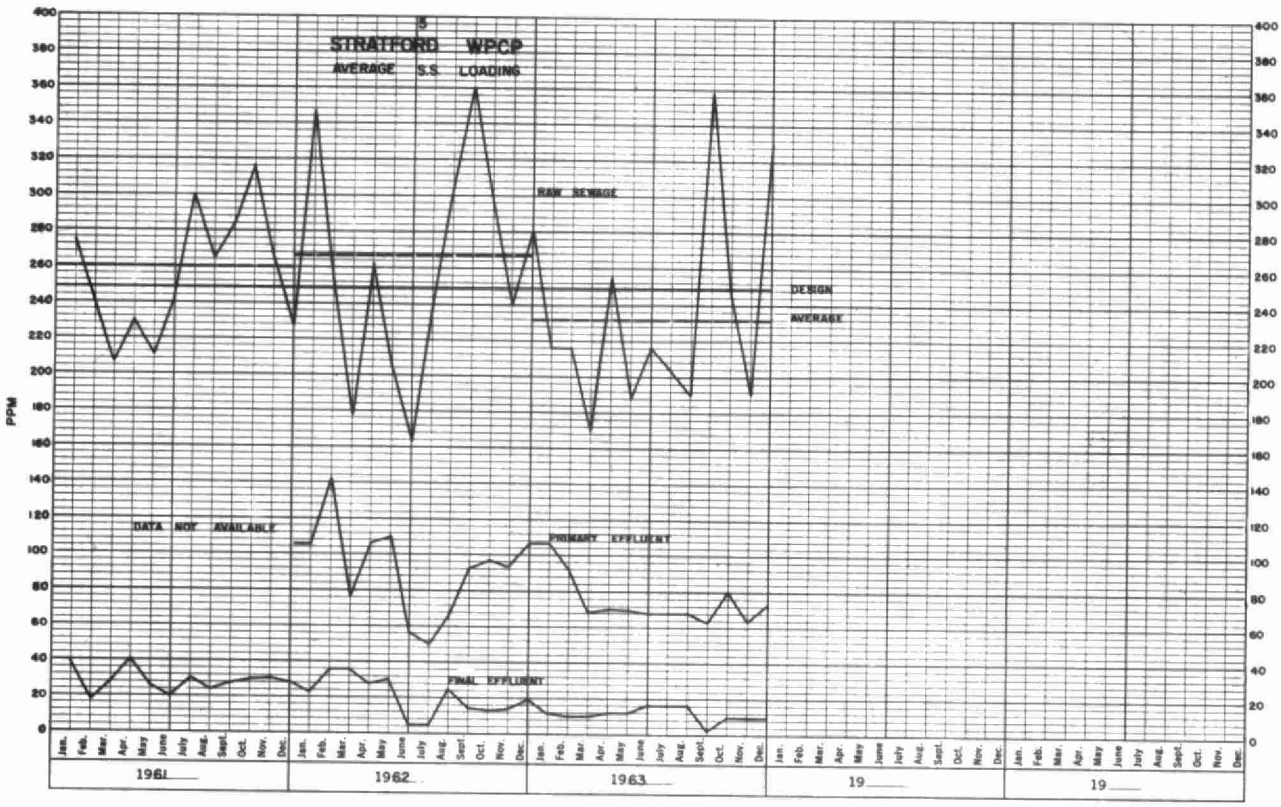



2
STRATFORD W.P.C.P
AVERAGE DAILY FLOW
DESIGN FLOW
2.80
2.60
2.10
YEARLY AVERAGES
AVERAGE DAILY FLOW IN MILLION GALLONS.
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1960
1961
1962
1963
1964



PERCENT OF SAMPLES EQUAL TO OR GREATER THAN


565
STRATFORD WPCP
AVERAGE BOD LOADING
RAW SEWAGE
AVERAGE
DATA NOT AVAILIBLE
PRIMARY EFFLUENT
RAW SEWAGE DESIGN
PLANT EFFLUENT
PPM.
1961
1962
1963
19
19

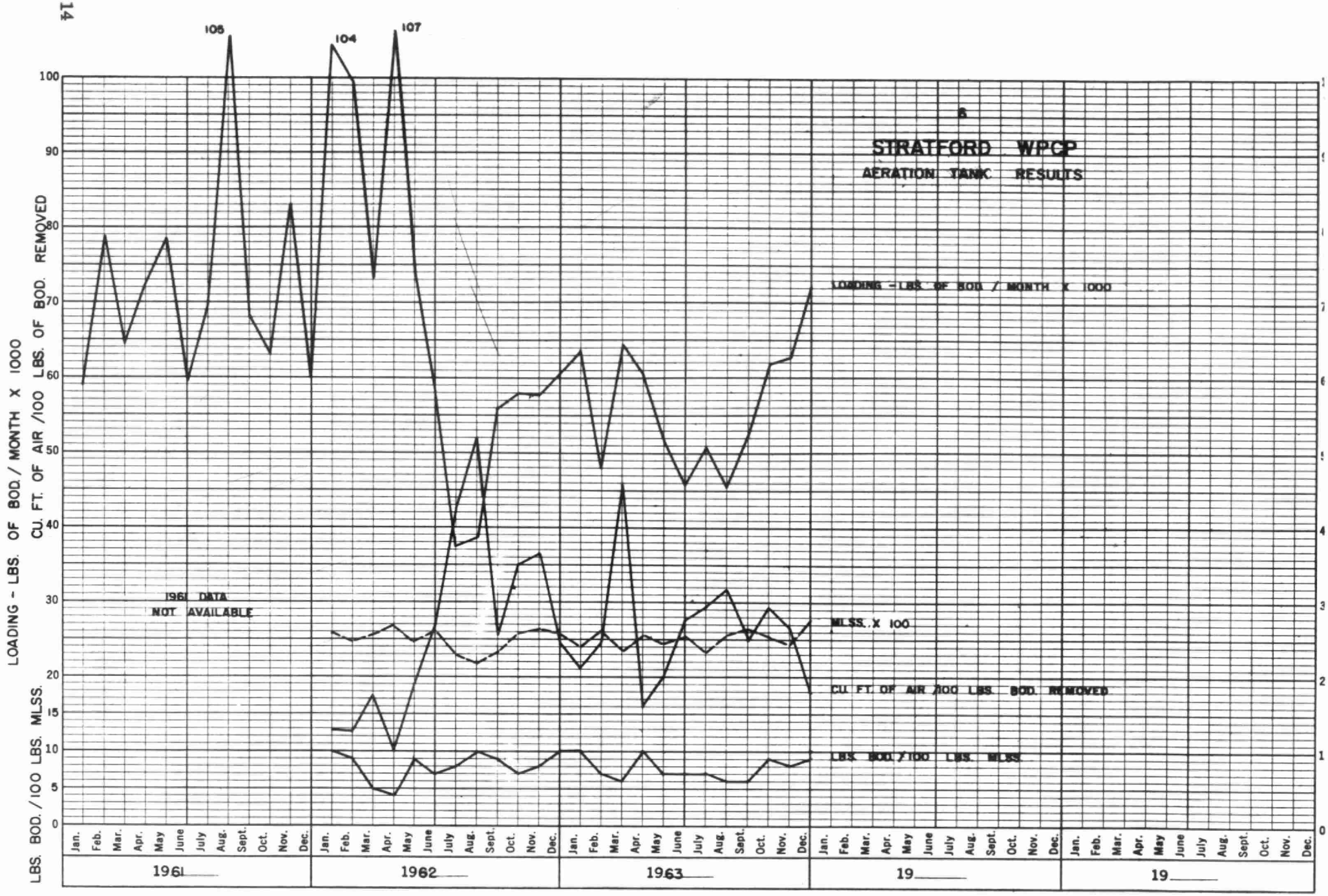

STRATFORD WPCP
AVERAGE S.S. LOADING
RAW SEWAGE
DESIGN AVERAGE
DATA NOT AVAILABLE
PRIMARY EFFLUENT
FINAL EFFLUENT
PPM
1961
1962
1963
19
19

GRIT, B.O.D AND S.S. REMOVAL

MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	262	19	92.5	55.94	216	12	94.5	46.96	28
FEB.	251	6.4	97.5	48.59	216	10	95.5	40.92	26
MAR.	96	9	90.5	58.28	150	10	93.5	93.79	92
APR.	181	6	96.5	60.80	255	12	95.0	84.43	101
MAY	190	4	98.0	69.79	187	12	93.5	65.66	40
JUNE	164	17	89.5	43.26	216	16	92.5	65.66	96
JULY	156	12	92.5	48.57	204	16	92.0	61.80	108
AUG.	150	8	94.5	51.42	189	16	91.5	62.64	59
SEPT.	160	10	93.5	39.31	358	2	99.5	93.29	88
OCT.	250	32	87.0	58.08	246	10	96.0	62.88	133
NOV.	365	25	93.0	92.26	211	9	95.5	54.81	147
DEC.	565	13	97.5	132.87	331	10	97.0	77.26	44
TOTAL				815.05				810.10	962
AVG.	233	13	93.5	67.92	232	11	95.0	67.50	80

COMMENTS

The average BOD loading at this plant approaches quite closely to the design value of 250 PPM. Suspended solids loadings, however, average 60% greater than the design value of 140 PPM. Due to the versatility of the plant in treating the large flows received during spring runoff periods, the average effluent quality is superior to the Commission standard of 15 PPM BOD and suspended solids. Only during these periods of high flow is the effluent unable to meet these standards.

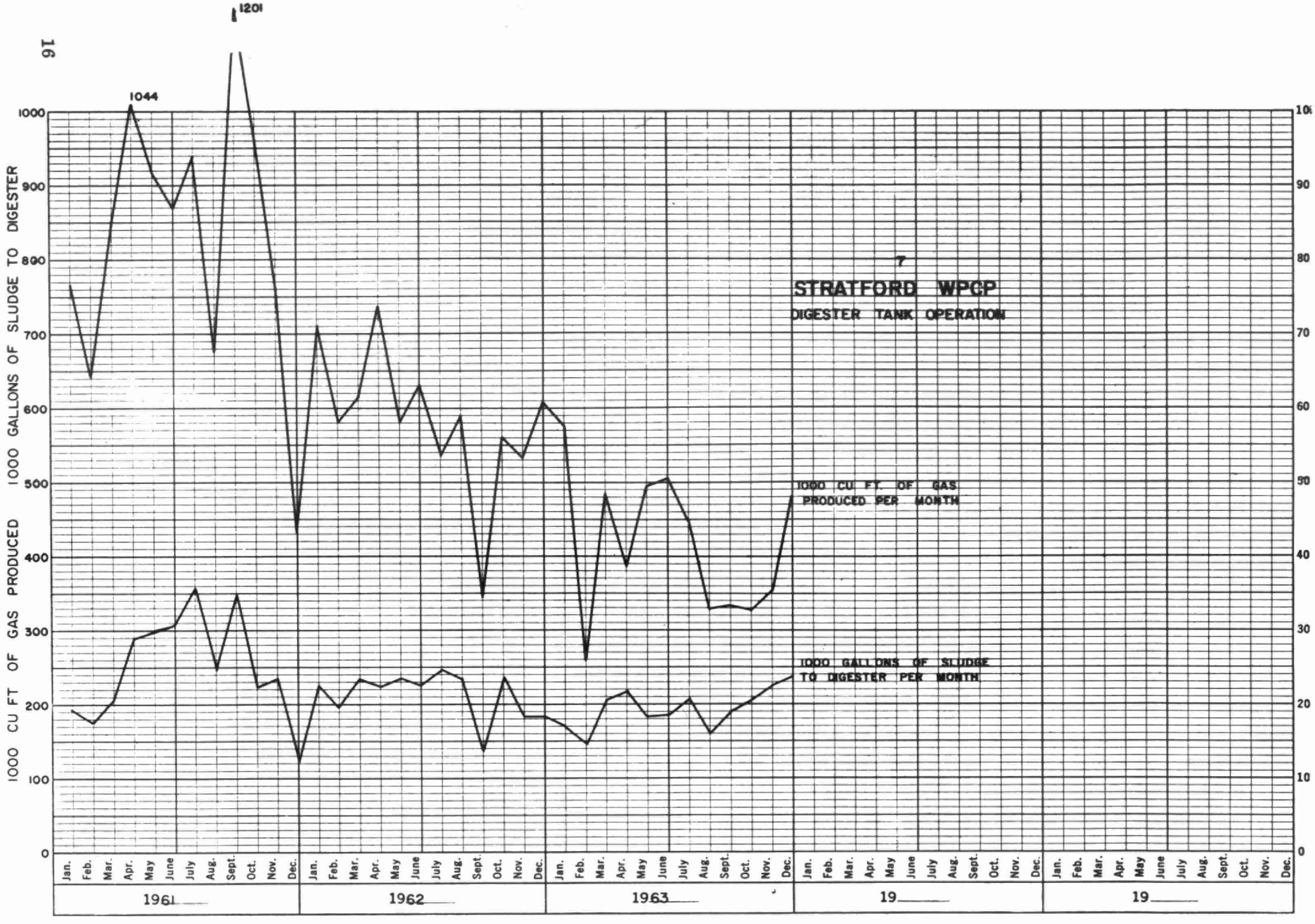

STRATFORD WPCP
AERATION TANK RESULTS
LOADING - LBS. OF BOD. / MONTH X 1000
CU. FT. OF AIR /100 LBS. OF BOD. REMOVED
LBS. BOD. /100 LBS. MLSS.
LOADING = LBS. OF BOD / MONTH X 1000
MLSS. X 100
CU. FT. OF AIR /100 LBS. BOD. REMOVED
LBS. BOD / 100 LBS. MLSS
1961 DATA NOT AVAILABLE
105
104
107
0
5
10
15
20
30
40
50
60
70
80
90
100
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1961
1962
1963
19
19

MONTH	PRIM. EFFL B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. BOD. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	138	2414	10	2106
FEBRUARY	121	2642	7	2483
MARCH	48	2354	6	4571
APRIL	87	2546	10	1605
MAY	69	2452	7	2003
JUNE	70	2548	7	2745
JULY	63	2319	7	2929
AUGUST	63	2550	6	3175
SEPTEMBER	100	2638	6	2492
OCTOBER	116	2555	9	2915
NOVEMBER	115	2429	8	2640
DECEMBER	150	2718	9	1766
TOTAL	1140	30165	92	31430
AVERAGE	95	2513	7.7	2619

* MLSS - Mixed Liquor Suspended Solids

COMMENTS

The aeration loadings indicate an average primary reduction in BOD for about 60%. The aeration loading of 7.7 pounds BOD per 100 pounds MLSS is considerably less than the 20 pounds usually recommended. The MLSS is kept at a relatively high value to counteract the foam problem. The use of fuel oil as a defoaming agent also assists in suppressing foam. A defoaming spray system may eventually be necessary if the foam problem increases in proportion. The effluent quality is not impaired by the high MLSS.


16
1201
1044
1000
900
800
700
600
500
400
300
200
100
0
1000 CU FT OF GAS PRODUCED 1000 GALLONS OF SLUDGE TO DIGESTER
7
STRATFORD WPCP
DIGESTER TANK OPERATION
1000 CU FT. OF GAS PRODUCED PER MONTH
1000 GALLONS OF SLUDGE TO DIGESTER PER MONTH
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
1961
1962
1963
19
19

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			% VOL. MAT IN DIGESTED SLUDGE	GAS PRODUCED 1000'S CU. FT.	SLUDGE FROM DIGESTER 1000'S GALS
	1000'S GALLONS	% SOLIDS	% VOL. MAT.			
JAN.	170.94	5.6	75	60	575.95	128.55
FEB.	149.26	5.1	78	71	259.60	NIL
MAR.	203.01	6.1	73	40	484.46	85.72
APR.	216.50	7.2	67	61	385.87	110.29
MAY.	183.21	6.6	68	51	494.23	338.48
JUNE	185.73	6.5	65	48	505.22	266.53
JULY	204.82	6.7	63	52	448.67	300.06
AUG.	158.03	6.0	64	50	328.70	307.81
SEPT.	190.27	5.6	69	58	331.80	206.39
OCT.	205.33	5.2	73	59	328.36	215.82
NOV.	224.00	4.8	74	64	351.63	252.38
DEC.	236.98	4.8	71	62	480.21	126.19
TOTAL	2328.08	702	840	676	4974.70	2338.22
AVG.	194.01	4.9	70	56	414.56	194.85

COMMENTS

During winter months, digested sludge is stored in an open concrete holding tank to be hauled away when weather conditions allow access to dumping areas. For this reason, it is difficult to measure the gallons of sludge taken from the digester accurately. Although the above chart indicates no supernatant being drawn off, a certain amount of supernatant is returned to the aeration section. Good gas production and volatile solids reduction indicate a successful digestion process.

1963

PLANT — **Total Operating Costs** — **MONTHLY**

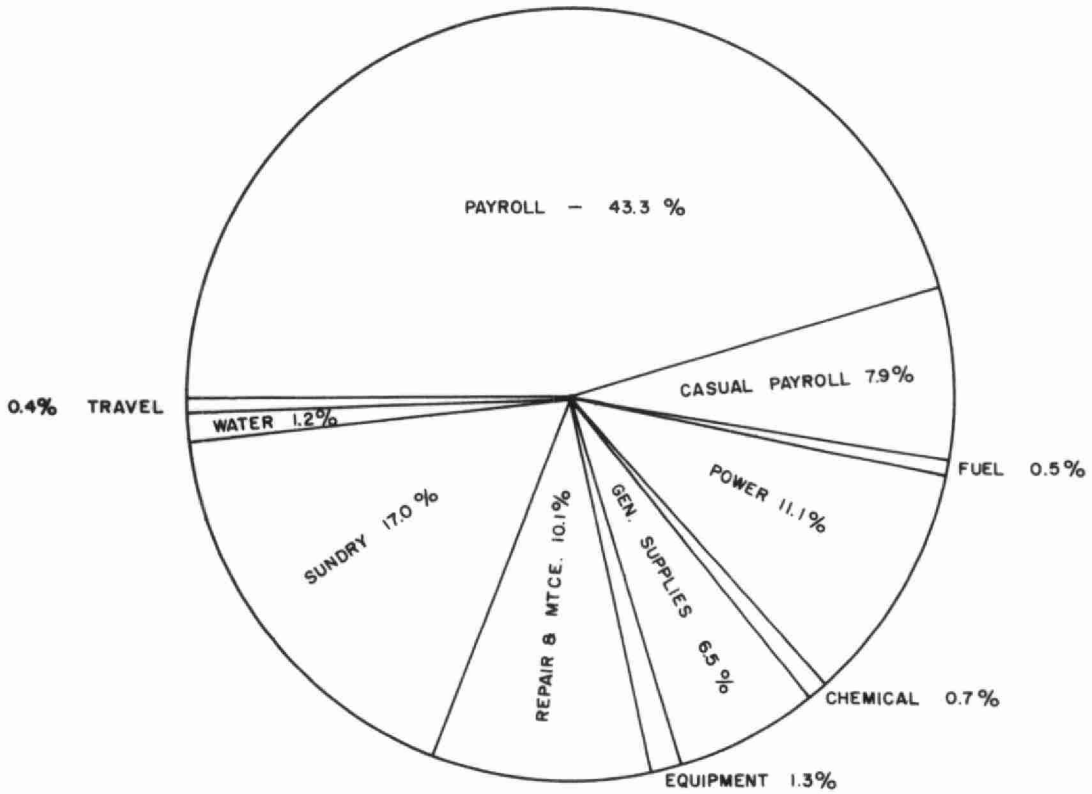
MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	SUNDRY	WATER
JAN	2249.71	1902.79	220.36	--	--	6.80	57.76	--	30.00	32.00	--
FEB	4466.11	1766.35	231.92	76.91	449.06	109.82	174.60	--	1119.49	487.16	50.80
MARCH	3140.13	1817.21	231.92	157.00	443.77	24.68	18.86	--	285.66	110.23	50.80
APRIL	2854.66	1680.60	208.80	58.53	433.94	45.90	73.97	59.40	156.40	86.32	50.80
MAY	4277.65	1753.65	257.26	--	457.81	132.16	145.12	321.88	48.62	1110.35	50.80
JUNE	4221.40	2034.90	274.30	(19.91)	445.93	--	318.95	--	121.00	1043.61	50.80
JULY	5575.67	2971.38	661.35	--	428.65	--	401.22	96.69	246.23	718.18	51.97
AUG	4923.29	1990.78	633.67	--	415.48	--	252.96	115.69	542.73	919.64	52.34
SEPT	3887.39	2007.06	305.97	--	458.89	--	847.46	15.80	144.95	54.92	52.34
OCT	5127.39	1984.96	217.38	(22.99)	475.09	47.34	285.40	1.80	366.55	1719.52	52.34
NOV	4239.92	1997.68	218.09	24.16	467.42	--	390.22	79.13	202.38	808.50	52.34
DEC	7836.48	3044.90	324.64	--	903.74	--	168.54	--	1760.73	1529.25	104.68
TOTAL	52799.80	24952.26	3785.66	273.70	5379.78	366.70	3135.06	690.39	5024.74	8535.46	620.01

PLANT — **YEARLY**

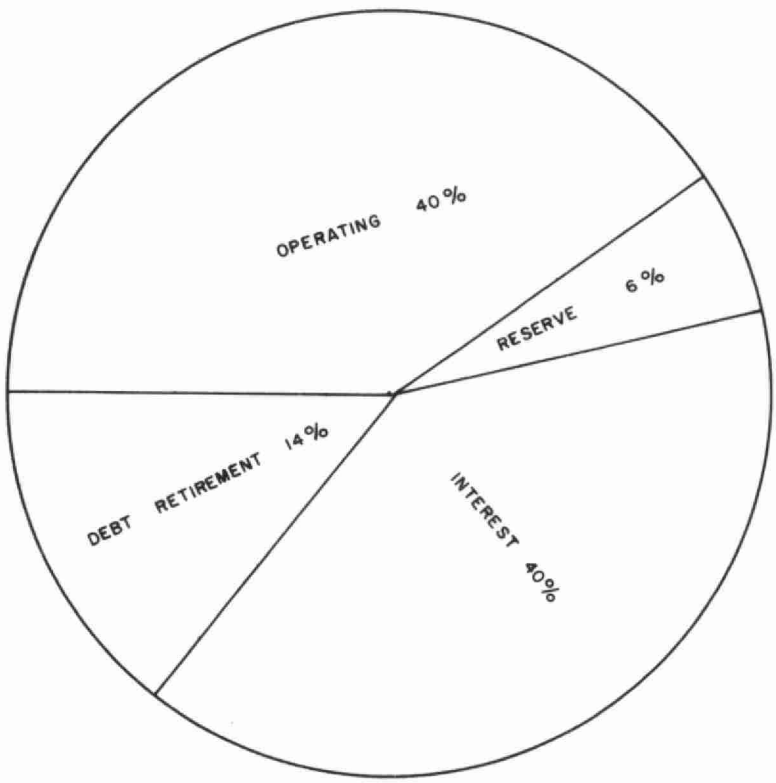
YEAR	M.G. TREATED	TOTAL COST	COST PER MILLION GALLONS	COST PER CAPITA PER YEAR	COST PER TON OF BOD REMOVED
1961	933.41	55,015.86	$58.94	$2.64	$37.00
1962	765.39	48,157.96	$62.92	$2.31	$63.00
1963	774.22	52,799.80	$68.15	$2.53	$65.00
		POPULATION - 20,857 FROM 1963 MUNICIPAL DIRECTORY			

STRATFORD W.P.C.P.

1963 OPERATING COSTS



TOTAL COSTS



SUMMARY

This report has given in detail significant data on the operation of the various treatment units at the Stratford Water Pollution Control Plant.

With an average daily flow of 2.12 million gallons, the plant is operating well below its full treatment capacity of 4.0 million gallons per day. Future sanitary sewer extensions are expected to increase the flow gradually in future years. The primary part of this plant is capable of treating flows up to 16 million gallons per day and complete treatment can be given to 8 million gallons per day for short periods. This versatility allows the plant to handle flows in excess of four times the design flow received during spring break-up.

Chlorination of the final effluent is not practiced at the Stratford plant at the present time. After extensive surveys of the Avon River watershed, the Division of Sanitary Engineering of the Ontario Water Resources Commission has recommended that consideration be given to installing chlorination facilities in the near future. This addition to the treatment is proposed to disinfect the final effluent killing all pathogenic bacteria which may be present.

Operating costs have continued to increase due to increased costs of labour, supplies and to increased maintenance. The treatment cost of $68.00 per million gallons is considered quite economical.

Under the constant supervision of head office engineers, the plant staff has maintained a clean, attractive, and efficient plant for the City of Stratford. A special emphasis is placed on public relations and aesthetic qualities of the plant. Each year hundreds of tourists and many groups tour the facilities.

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Total 1963 Costs

The total cost to the municipality during 1963 was as follows:

Operating	$ 52,799.80
Debt Retirement	$ 18,666.00
Reserve	$ 7,881.00
Interest	$ 52,108.89
TOTAL	$131,455.69

Note: The amount in the reserve account as of December 31st, 1963 was $42,378.12.

Based on a population of 20,857, the total annual cost of the Stratford Water Pollution Control Plant was approximately $6.30 per person.

Division of Plant Operations

ONTARIO WATER RESOURCES COMMISSION
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